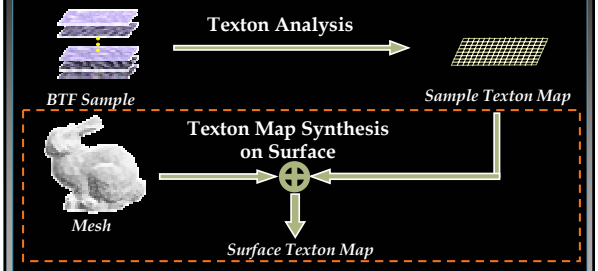
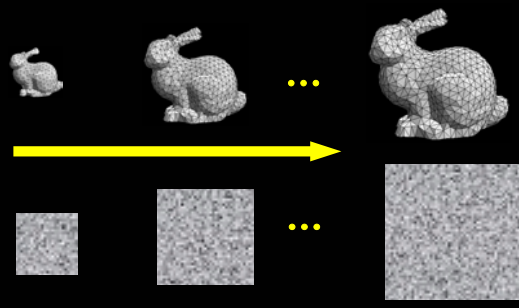
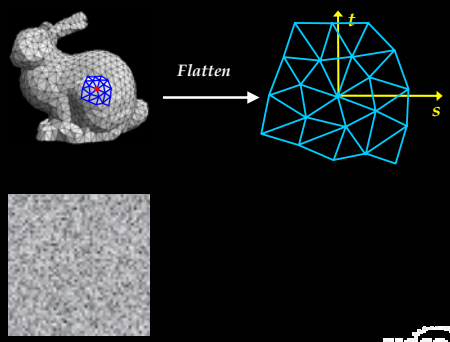
Texton Map Synthesis on Surface



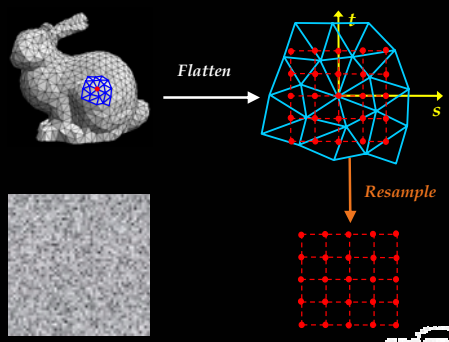
Multiresolution Synthesis



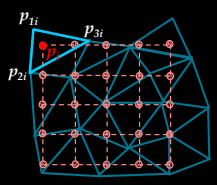
Flatten



Resample



Resample

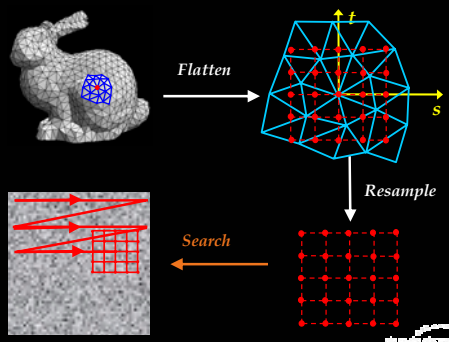


$v(p_i) = \alpha v(p_{1i}) + \beta v(p_{2i}) + \gamma v(p_{3i})$

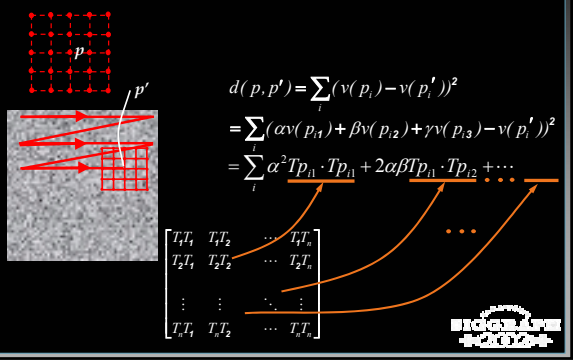
We store $(\alpha, \beta, \gamma, Tp_{1i}, Tp_{2i}, Tp_{3i})$

Texton labels

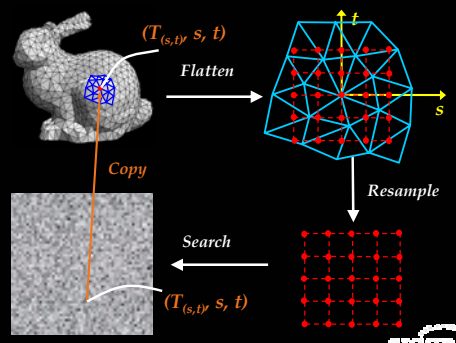
Search



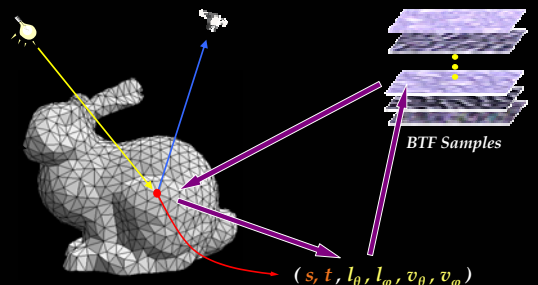
Search



Copy



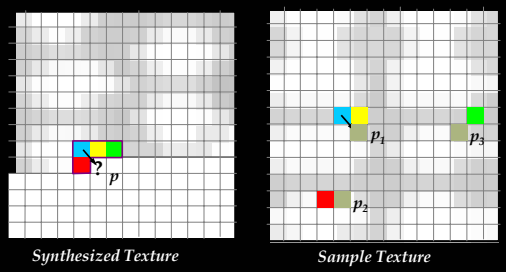
Surface Texton Map & Rendering



Accelerated Search

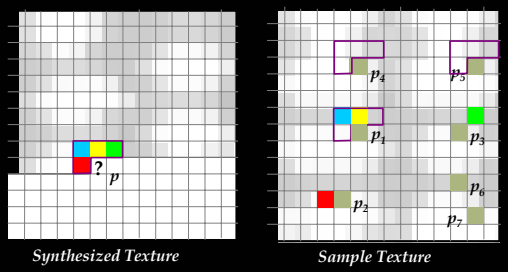
- Problem
  - Full search is very slow
  - K-D tree and TSVQ do not work well for BTF
- Solution
  - K-Coherence search
  - Only search "good" candidates in sample texton map

Ashikhmin's Observation



1-Coherence Candidates:

Our Observation



K-Coherence Candidates:

Algorithm

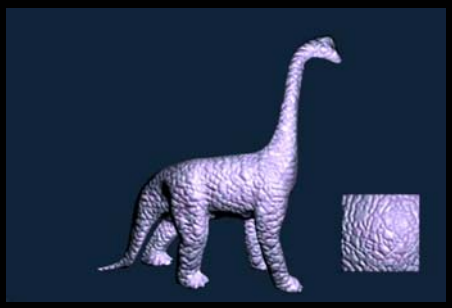
- Before Search
  - Precompute K-Coherence (K>1) candidates for each pixel in sample texton map
  - K < 12 is enough for our samples
- During Search
  - Only search the K-Coherence candidates in sample texton map

Synthesis Performance

Sample Size	Full Search	K-Coherence
64 × 64	747 minutes	70 minutes
96× 96	3,000 minutes	123 minutes
128× 128	8,066 minutes	157 minutes

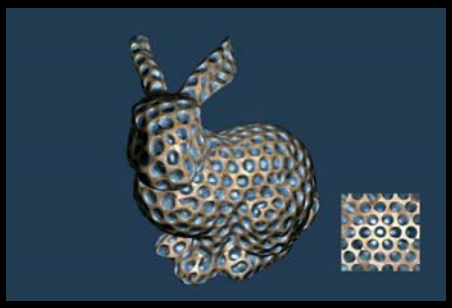
- *Pentium III 700MHZ CPU*
- *Mesh with 250k vertices*
- *k = 11 for k-Coherence search*

Synthesis from Real World Samples



3600 BTF samples of 64×64, 250K vertices

Synthesis from Synthetic Samples



3600 BTF samples of 128×128, 300K vertices

Summary

- Surface Texton for BTF Synthesis
- Automatic BTF Synthesis on Surface
- K-Coherence Search for Fast BTF Synthesis

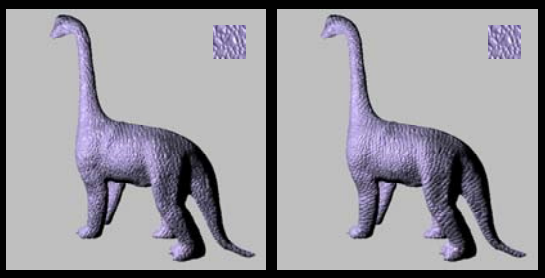
Acknowledgement

- Xinguo Liu, Yanyun Chen, Gang Chen and Yin Li (BTF Sample Data)
- Steve Lin (Video Production)

Thank You!

Thank You!

Synthesis Quality



Full Search *K-Coherence (K=11)*

Experimental Results

BTF (6D)

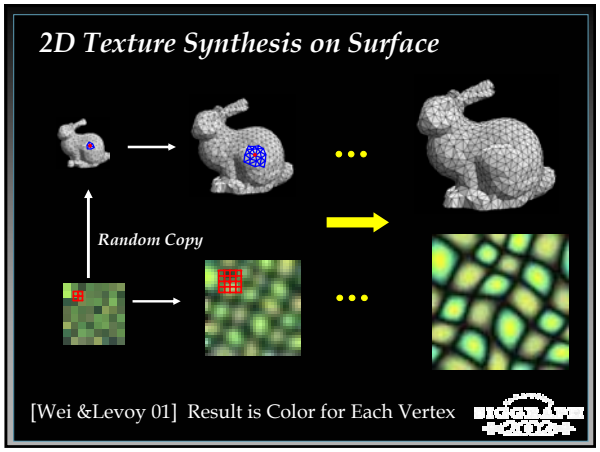
Fix Lighting → Surface Lightfield (4D) without subsurface scattering

Fix Viewing → Polynomial Texture Mapping (4D)

Diffuse, Nearly flat → Bump Mapping (2D)

Related Work

- BTF Synthesis
  - BTF morphing [Dana & Nayar 99]
  - **BTF synthesis for real world surface [Liu et. al. 01]**
- BTF Representation
  - Histogram model [Dana & Nayar 99]
  - Correlation model [Suen & Healey 00]


2D Texture Synthesis on Surface
Random Copy
[Wei &Levoy 01] Result is Color for Each Vertex